



LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA22 | Whittington to Handsacre

Water resources assessment (WR-002-022)

Water resources

November 2013

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Department for Transport

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Appendix WR-002-22

Environmental topic:	Water resources and flood risk assessment	WR
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Community forum area:	Whittington to Handsacre	022

Contents

Appendix WR-002-22	i	
1	Introduction	3
1.1	Structure of the water resources and flood risk assessment appendices	3
1.2	Study area	3
2	Stakeholder engagement	4
3	Baseline data	5
3.1	General	5
3.2	Surface water features	5
3.3	Groundwater	28
3.4	Groundwater/surface water interaction	31
3.5	Water-dependent habitats	36
4	Site-specific assessments	40
4.1	Surface water	40
4.2	Groundwater	72
5	References	97

List of tables

Table 1: Surface water features within 1km of the route the Whittington to Handsacre study area	6
Table 2: Licensed surface water abstractions	23
Table 3: Permitted discharges to surface water	24
Table 4: Licensed groundwater abstractions	29
Table 5: Groundwater discharge environmental permits	30
Table 6 : Groundwater/surface water interaction	31
Table 7: Description of water-dependent habitats	37
Table 8: Summary of potential impacts to surface water	41
Table 9: Aquifer properties	72
Table 10: Maximum extent of zone of influence in the Whittington to Handsacre study area	73
Table 11: Summary of potential impacts to groundwater, abstractions, water-dependent habitats and groundwater/ surface water interactions	74

1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise four parts. The first of these is a route-wide appendix (Appendix WR-001-000).
- 1.1.2 Three specific appendices for each community forum area (CFA) are also provided. For the Whittington to Handsacre area these are:
 - a Water Resources Assessment (i.e. this appendix);
 - a Flood Risk Assessment (Appendix WR-003-022); and
 - a River Modelling Report (Appendix WR-004-015).
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5: Map Book – Water resources, Maps WR-01 to WR-06 and the Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

1.2 Study area

- 1.2.1 The study area is located between Whittington Heath and Armitage within the county of Staffordshire. It is predominantly rural and overlies both superficial and bedrock aquifers. Topography ranges from approximately 65 to 100m above Ordnance Datum (AOD)
- 1.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity, as outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, a professional judgement was made in selecting the appropriate limit to the extension in spatial scope required.
- 1.2.3 Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the Proposed Scheme, or within the calculated zone of influence, and therefore potentially affected by the Proposed Scheme have been listed in the baseline.

2 Stakeholder engagement

2.1.1 Discussion with the following stakeholders has been undertaken to inform the water resources assessment.

- the Environment Agency on 31 September 2012 to discuss multiple aspects of the Proposed Scheme;
- the Environment Agency and Staffordshire Lead Local Flood Authority (LLFA) on 21 December 2012; and
- the Environment Agency on 4 June 2013.

3 Baseline data

3.1 General

3.1.1 The following section provides a current description of water resources including surface water and groundwater.

3.2 Surface water features

3.2.1 All surface water features within 1 km of the Proposed Scheme are presented in Table 1.

3.2.2 The current surface water baseline is shown in Volume 5: Map Book – Water resources, Maps WR-01-037 and WR-01-038. Where a water feature in Table 1 has been given a map reference it appears on one of these maps.

Appendix WR-002-022 | Baseline data

Table 1: Surface water features within 1km of the route the Whittington to Handsacre study area

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary to Brook Leasow	At Packington Hall Farm, 690m east of the route. Map WR-01-037 (H5)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain feeder to Fisherwick Brook	At Mill Farm, will be crossed by the route. (SWC-CFA22-001) Map WR-01-037 (E5)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	0.862m ³ /s	River Tame	14.78 km ²	

¹ Only ponds within the land required for the permanent Proposed Scheme are listed in this table.

² Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-037 and WR-01-038.

³ Environment Agency water-feature classification: The Land Drainage Act 1991 defines an Ordinary watercourse as 'A watercourse that is not part of a main river, all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. 'Main Rivers' are larger rivers and streams designated by DEFRA, main rivers are regulated by the Environment Agency.

⁴ Year may vary in different RBMPs.

⁵ Environment Agency (2009), *River Basin Management Plan: Humber River Basin District*.

⁶ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

⁷ Q95 flow values only provided for water features that will be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary to Fisherwick Brook	At Mill Farm, 65m west of the route. Map WR-01-037 (F6)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Wyrley and Essington Canal (under restoration)	At Canal Cottage Capper's Lane, will be crossed by the route. (SWC-CFA22-002) Map WR-01-037 (E5)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	0.862m ³ /s	River Tame	14.78km ²	
Coventry Canal	At Huddlesford Junction – Huddlesford, 35m east of the route. Map WR-01-037 (E5)	Ordinary watercourse	Coventry and Ashby Canals (GB70910212) Good Potential	Good Potential (by 2015)	High	-	Coventry and Ashby Canal		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Fisherwick Brook	At Bowmans Bridge – Huddlesford, 330m east of the route. Map WR-01-037 (E5)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Mare Brook	At Birch Wood – Streethay, will be crossed by the route. (SWC-CFA22-003) Map WR-01-037 (E5)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	0.002m ³ /s	River Tame	1.18km ²	
Drain feeder to Fisherwick Brook	At Barn Cottage – Broad Lane, 950m east of the route. Map WR-01-037 (E4)	Ordinary watercourse	East Litchfield catchment – tributary of Tame (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to Mare Brook	At Thatchmoor Farm – Brookhay, 720m east of the route. Map WR-01-037 (D4)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain feeder to Mare Brook	At Kings Orchard Bridge, 340m east of the route. Map WR-01-037 (D5)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Mare Brook	At Rough Stockings – Streethay, will be crossed by the route. (SWC-CFA22-004) Map WR-01-037 (C6)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	0.004m ³ /s	River Tame	1.77km ²	

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Pond	North of Rough Stockings, will be crossed by the route. (SWC-CFA22-005) Map WR-01-037 (C6)	Not applicable	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Refer to Ecology Volume 2, CFA Report 22, Section 7.	-	-		
Drain feeder to Mare Brook	At Streethay House Farm – Streethay, 335m west of the route. Map WR-01-037 (D7)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain feeder to Mare Brook	At East Hill – Hilliards Cross, 100m east of the route. Map WR-01-037 (C5)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Mare Brook	At East Hill – Hilliards Cross, will be crossed by the route. (SWC-CFA22-006) Map WR-01-037 (B6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	0.001m ³ /s	River Trent	0.581km ²	
Tributary of Curborough Brook	At Curborough House – Curborough, 745m west of the route. Map WR-01-037 (B7)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of Mare Brook	At East Hill – west of Wood End Lane, 20m west of the route. Map WR-01-037 (B6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route. Under construction/landscaping footprint.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Pond	Pond south of East Hill, 20m west of the route. Map WR-01-037 (B6)	Not applicable	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Refer to Ecology Volume 2, CFA Report 22, Section 7.	-	-		Will not be crossed by the route. Under construction/landscaping footprint.
Tributary of Mare Brook	At Wood End Lane – Hilliards Cross, will be crossed by the route. (SWC-CFA22-007) Map WR-01-037 (B6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	0.001m ³ /s	River Trent	0.581km ²	
Pond	At Wood End Lock, will be crossed by the route. (SWC-CFA22-008) Map WR-01-038 (G5)	Not applicable	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Refer to Ecology Volume 2, CFA Report 22, Section 7.	-	-	-	

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Curborough Brook	At Curborough Farm, 935m west of the route. Map WR-01-038 (H7)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Drain feeder to Curborough Brook	North east of Curborough Farm, 690m east of the route. Map WR-01-038 (H7)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Trent and Mersey Canal	At Fradley Wood, will be crossed by the route. (SWC-CFA22-009) Map WR-01-038 (G5)	Ordinary watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) Good Potential	Good Potential (by 2015)	Moderate	-	Trent and Mersey Canal		
Full Brook – Tributary of Curborough Brook	At Full Brook and Wood End Farm, 430m west of the route. Map WR-01-038 (G6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to Curborough Brook	At Big Lyntus – Car Sprint Course, 370m west of the route. Map WR-01-038 (G6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of Curborough Brook	At Wood End Lock Cottage, 130m west of the route. Map WR-01-038 (G5)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Curborough Brook	At Wood End Lock, will be crossed by the route. (SWC-CFA22-010) Map WR-01-038 (G5)	Main River	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	High	0.04m ³ /s	River Trent	17.04km ²	

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to Curborough Brook	At Wood End Lock Cottage, 135m west of the route. Map WR-01-038 (G5)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Trent and Mersey Canal	At Wood End Lock, will be crossed by the route. (SWC-CFA22-011) Map WR-01-038 (F5)	Ordinary watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) Good Potential	Good Potential (by 2015)	Moderate	-	Trent and Mersey Canal		
Drain	At Ravenshaw Cottage, 85m east of the route. Map WR-01-038 (F6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Drain	At Ravenshaw Wood Map WR-01-038 (F6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Ashby Sitch (feeder of Bourne Brook)	At Rice's Spinney, 330m east of the route. Map WR-01-038 (E6)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) Moderate Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Drain	At Wharf Farm Barn, 120m east of the route. Map WR-01-038 (E6)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Drain	At Slaish – Ravenshaw Cottage, 220m east of the route. Map WR-01-038 (E6)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Drain	At Black Slough, 200m west of the route Map WR-01-038 (E7)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route. Assumed to be drainage from outfall / balancing pond.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Bourne Brook	At Shaw Lane – Kings Bromley Wharf, 610m east of the route. Map WR-01-038 (D7)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Bourne Brook	At John's Gorse, will be crossed by the route. (SWC-CFA22-012) Map WR-01-038 (E7)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	High	0.081m ³ /s	River Trent	28.57km ²	
Tributary of Bourne Brook	At John's Gorse, 20m east of the route. Map WR-01-038 (E7)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Pond	At John's Gorse, will be crossed by the route. (SWC-CFA22-013) Map WR-01-038 (E8)	Not applicable	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Refer to Ecology Volume 2, CFA Report 22, Section 7.	-	-		

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Bourne Brook	At Hanchwood House, 210m east of the route. Map WR-01-038 (E7)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Ben Brook – Tributary of Bilson Brook	At Lysways Lane, 990m west of the route. Map WR-01-038 (E9)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Lake	Hanch Farm, 720m west of the route. Map WR-01-038 (E9)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of Bourne Brook	At Hanch Farm, 730m west of the route. Map WR-01-038 (E9)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to Bourne Brook	At Hanch Reservoir, 720m west of the route. Map WR-01-038 (E9)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) Good Status	Good Status (by 2015)	Moderate	-	River Trent		Will not be crossed by the route.
Drain	At Harvey's Rough/Shaw Lane Farm, will be crossed by the route. (SWC-CFA22-014) Map WR-01-038 (D8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		
Tributary of River Trent	At Harveys Rough, will be crossed by the route. (SWC-CFA22-015) Map WR-01-038 (D8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	0.001m ³ /s	River Trent	0.295km ²	

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to River Trent	At Litchfield Road (B5014), 70m west of the route. Map WR-01-038 (D8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of River Trent	At Ashton Hays, will be crossed by the route. (SWC-CFA22-016) Map WR-01-038 (C8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	0.001m ³ /s	River Trent	0.574km ²	
Tributary of River Trent	At Litchfield Road (B5014), will be crossed by the route. (SWC-CFA22-017) Map WR-01-038 (C8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	0.001m ³ /s	River Trent	0.574km ²	

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to Trent and Mersey Canal	At Tuppenhurst Farm – Handsacre, 965m east of the route. Map WR-01-038 (C7)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of Shropshire Brook	At Shropshire Brook Road – Handsacre, 1000m west of the route. Map WR-01-038 (B9)	Ordinary watercourse	Longdon/Armitage Catchment – tributary of Trent (GB104028047260) Moderate Status	Good Status	Moderate	-	River Trent		Will not be crossed by the route.
Drain feeder to Shropshire Brook	At Hood Lane Covert, 975m west of the route. Map WR-01-038 (C10)	Ordinary watercourse	Longdon/Armitage Catchment – tributary of Trent (GB104028047260) Moderate Status	Good Status	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of River Trent	At White Gables, will be crossed by the route. (SWC-CFA22-18) Map WR-01-038 (C8)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status Objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain feeder to River Trent	At Tuppenhurst Farm – Handsacre, 575m east of the route. Map WR-01-038 (C7)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Drain feeder to River Trent	At Marsh Barn Farm – Handsacre, 1000m east of the route. Map WR-01-038 (B7)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Tributary of River Trent	At Marsh Barn Farm – Handsacre, 1000m east of the route. Map WR-01-038 (B7)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) Poor Potential	Good Potential	Moderate	-	River Trent		Will not be crossed by the route.
Shropshire Brook – Feeder of Trent and Mersey Canal	At Handsacre, 675m west of route. Map WR-01-038 (B9)	Main River	Longdon/Armitage Catchment – tributary of Trent (GB104028047260) Moderate Status	Good Status	High	-	River Trent		Will not be crossed by the route.

3.2.3 Table 2 summarises licensed surface water abstractions within 1km of the route. Information from Lichfield District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

Table 2: Licensed surface water abstractions

Licence identifier (map reference number ⁸ and Environment Agency reference)	Distance from route	Abstraction source	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Purpose
03/28/22/0042 Map WR-01-037 (F6)	475m west of the route	Mill Farm, The Darnford Brook	17,273m ³	818m ³	Spray irrigation – direct
03/28/22/0042 Map WR-01-037 (F6)	475m west of the route	Mill Farm, The Darnford Brook	17,273m ³	818m ³	Spray irrigation – storage
03/28/22/0035 Map WR-01-037 (E6)	475m west of the route	Marsh Farm – Tributary of River Tame	15,911m ³	727m ³	Spray irrigation – storage
03/28/22/0085/1 Map WR-01-037 (E6)	485m west of the route	Darnford Lane, Lichfield – Darnford Brook	6,000m ³	300m ³	Supply to a canal for throughflow
03/28/22/0045 Map WR-01-037 (E5)	280m east of the route	Whittington Farms, Coventry Canal – Point A	15,000m ³	818m ³	Spray irrigation – direct
03/28/22/0045 Map WR-01-037 (D5)	280m east of the route	Whittington Farms, Coventry Canal – Point B	15,000m ³	818m ³	Spray irrigation – direct
03/28/07/0089 Map WR-01-038 (G6)	325m south-west of the route	Wood End Farm, Curborough – Pyford Brook	9,000m ³	500m ³	Spray irrigation – direct
03/28/07/0068 Map WR-01-038 (G6)	175m south-west of the route	Curborough Hall Farm (Below Sewage Works)	17,500m ³	540m ³	Spray irrigation – direct
03/28/07/0056 Map WR-01-038 (G5)	25m south-west of the route	Alrewas Farm – Pyford Brook	60,000m ³	1440m ³	Spray irrigation – direct
03/28/07/0102 Map WR-01-038 (G5)	25m south-west of the route	Alrewas Farm – Pyford Brook	40,000m ³	960m ³	Spray irrigation – direct
03/28/17/0056 Map WR-01-038 (G5)	25m south-west of the route	Alrewas Farm – Pyford Brook	6,365m ³	436m ³	Spray irrigation – direct

3.2.4 Table 3 summarises permitted discharges to surface water within 1km of the route.

⁸ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-037 and WR-01-038.

Appendix WR-002-022 | Baseline data

Table 3: Permitted discharges to surface water

Reference number and map reference ⁹	Permit identifier	Distance from route	Discharge type	Receiving water body
22690584 Map WR-01-037 (G3)	T/22/35965/S	915m east of the route	Sewage discharge	Tributary of Darnford Brook
55616437 Map WR-01-037 (F5)	Npswqd005076	55m east of the route	Sewage discharge	Stream to Darnford Brook
1243674 Map WR-01-037 (E5)	T/22/03449/S	765m east of the route	Sewage discharge	Tributary of the River Tame
1243749 Map WR-01-037 (E5)	T/22/02233/S/1	565m east of the route	Sewage discharge	Darnford Brook (Tame)
1243697 Map WR-01-037 (E5)	T2233/1	565m east of the route	Sewage discharge	Darnford Brook (Tame)
22967764 Map WR-01-037 (E5)	T/22/35977/S	645m east of the route	Sewage discharge	Tributary of Darnford Brook
97332052 Map WR-01-037 (E5)	Eprjp3327xf	525m east of the route	Sewage discharge	Tributary of Fisherwick Brook
1243959 Map WR-01-037 (E6)	T/22/21712/O	460m west of the route	Sewage discharge	Mare Brook
1243916 Map WR-01-037 (E6)	T/22/30086/O	460m west of the route	Sewage discharge	Mare Brook
20358046 Map WR-01-037 (E6)	T/22/35697/O	460m west of the route	Sewage discharge	Mare Brook
96122599 Map WR-01-037 (E6)	Tsc4014	460m west of the route	Sewage discharge	Mare Brook
96122346 Map WR-01-037 (E6)	Tsc3195	675m west of the route	Sewage discharge	Mare Brook
1246259 Map WR-01-037 (C5)	T/22/35384/T	75m north-east of the route	Trade discharge	Mare Brook
14200771 Map WR-01-038 (H6)	T/07/35455/S	890m south-west of the route	Sewage discharge	Curborough Brook
1245769 Map WR-01-038 (H5)	T/22/12269/O	90m north-east of the route	Sewage discharge	Westhill Brook

⁹ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-037 and WR-01-038.

Reference number and map reference ⁹	Permit identifier	Distance from route	Discharge type	Receiving water body
96122584 Map WR-01-038 (H5)	Tsc4078	90m north-east of the route	Sewage discharge	Tributary of River Trent
35634939 Map WR-01-038 (H4)	T/22/36290/S	435m north-east of the route	Sewage discharge	Unnamed tributary of Mare Brook
35634940 Map WR-01-038 (H4)	T/22/36291/S	435m north-east of the route	Sewage discharge	Unnamed tributary of Mare Brook
1245871 Map WR-01-038 (G7)	T/07/12114/R	970m south-west of the route	Sewage discharge	Tributary of Curborough Brook
19449124 Map WR-01-038 (G7)	T/07/12114/R	970m south-west of the route	Sewage discharge	Tributary of Curborough Brook
96122497 Map WR-01-038 (G4)	Tsc3333	830m north-east of the route	Sewage discharge	Tributary of River Trent
19449122 Map WR-01-038 (G6)	T/07/12114/R	635m south-west of the route	Sewage discharge	Tributary of Curborough Brook
82636833 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
26342640 Map WR-038 (G6)	T/07/36033/R	6202m south-west of the route	Sewage discharge	Full Brook
82636837 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
64455092 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
64455091 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
82636835 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
82636838 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook
26342639 Map WR-038 (G6)	T/07/36033/R	620m south-west of the route	Sewage discharge	Full Brook

Reference number and map reference ⁹	Permit identifier	Distance from route	Discharge type	Receiving water body
82636832 Map WR-038 (G6)	T/07/36033/R	600m south-west of the route	Sewage discharge	Full Brook
64455090 Map WR-038 (G6)	T/07/36033/R	600m south-west of the route	Sewage discharge	Full Brook
26342641 Map WR-038 (G6)	T/07/36033/R	600m south-west of the route	Trade discharge	Full Brook
82636836 Map WR-038 (G6)	T/07/36033/R	600m south-west of the route	Sewage discharge	Full Brook
19449123 Map WR-038 (G6)	T/07/12114/R	600m south-west of the route	Sewage discharge	Tributary of Curborough Brook
26342638 Map WR-038 (G6)	T/07/36033/R	600m south-west of the route	Sewage discharge	Full Brook
1245874 Map WR-038 (G6)	T/07/12114/R	600m south-west of the route	Sewage discharge	Tributary of Curborough Brook
1245873 Map WR-038 (G6)	T/07/12114/R	600m south-west of the route	Sewage discharge	Tributary of Curborough Brook
19449126 Map WR-038 (G6)	T/07/12114/R	600m south-west of the route	Trade discharge	Tributary of Curborough Brook
19449125 Map WR-038 (G6)	T/07/12114/R	600m south-west of the route	Sewage discharge	Tributary of Curborough Brook
20999261 Map WR-01-038 (F8)	T/07/35763/S	925m south-west of the route	Sewage discharge	Full Brook and/or land
1245931 Map WR-01-038 (E8)	T/07/03169/S	320m south-west of the route	Sewage discharge	Bourne/Black/Crane Brook
8905810 Map WR-01-038 (E9)	Tr3743	640m south-west of the route	Trade discharge	Bourne Brook
8905824 Map WR-01-038 (E9)	T/07/03743/T	625m south-west of the route	Trade discharge	Bourne Brook
26660153 Map WR-01-038 (E9)	T/07/36041/S	625m south-west of the route	Trade discharge	Bourne Brook
26660152 Map WR-01-038 (E9)	T/07/36041/S	615m south-west of the route	Trade discharge	Bourne Brook
8905823 Map WR-01-038 (E9)	T/07/03743/T	615m south-west of the route	Trade discharge	Bourne Brook

Reference number and map reference ⁹	Permit identifier	Distance from route	Discharge type	Receiving water body
8905809 Map WR-01-038 (E9)	Tr3743	615m south-west of the route	Trade discharge	Bourne Brook
8905808 Map WR-01-038 (E9)	Tr3743	600m south-west of the route	Trade discharge	Bourne Brook
8905822 Map WR-01-038 (E9)	T/07/03743/T	600m south-west of the route	Trade discharge	Bourne Brook
26660151 Map WR-01-038 (E9)	T/07/36041/S	600m south-west of the route	Trade discharge	Bourne Brook
8905821 Map WR-01-038 (E8)	T/07/03743/T	470m south-west of the route	Trade discharge	Bourne Brook
26660150 Map WR-01-038 (E8)	T/07/36041/S	470m south-west of the route	Trade discharge	Bourne Brook
8905807 Map WR-01-038 (E8)	Tr3743	470m south-west of the route	Trade discharge	Bourne Brook
26660149 Map WR-01-038 (E8)	T/07/36041/S	465m south-west of the route	Sewage discharge	Bourne Brook
8905820 Map WR-01-038 (E8)	T/07/03743/T	465m south-west of the route	Sewage discharge	Bourne Brook
8905806 Map WR-01-038 (E8)	Tr3743	465m south-west of the route	Sewage discharge	Bourne Brook
36970933 Map WR-01-038 (E9)	T/07/36339/T	820m south-west of the route	Sewage discharge	Bourne Brook
26660148 Map WR-01-038 (E9)	T/07/36039/T	755m south-west of the route	Trade discharge	Bourne Brook
90726476 Map WR-01-038 (E9)	T/07/36039/T	755m south-west of the route	Trade discharge	Bourne Brook
90726475 Map WR-01-038 (E9)	T/07/36039/T	670m south-west of the route	Trade discharge	Bourne Brook
26660147 Map WR-01-038 (E9)	T/07/36039/T	670m south-west of the route	Trade discharge	Bourne Brook
8905811 Map WR-01-038 (E9)	Tr3743	645m south-west of the route	Trade discharge	Bourne Brook
8905825 Map WR-01-038 (E9)	T/07/03743/T	645m south-west of the route	Trade discharge	Bourne Brook

Reference number and map reference ⁹	Permit identifier	Distance from route	Discharge type	Receiving water body
26660154 Map WR-01-038 (E9)	T/07/36041/S	645m south-west of the route	Trade discharge	Bourne Brook
8900280 Map WR-01-038 (D6)	T/07/35372/S	970m north-east of the route	Sewage discharge	Tributary of Bourne Brook
32882710 Map WR-01-038 (C8)	T/05/36201/S	105m south-west of the route	Sewage discharge	Tributary of River Trent
1234356 Map WR-01-038 (B8)	T/07/02696/O	745m north of the route	Sewage discharge	Trent/Mersey Canal (Tributary)

3.3 Groundwater

3.3.1 There are two groundwater bodies within CFA22:

- Tame Anker Mease – PT Sandstone Birmingham Lichfield (GB40401G301000); and
- Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures (GB40402G300300).

3.3.2 The Tame Anker Mease – Permo-Triassic Sandstone Birmingham Lichfield water body has poor chemical and quantitative quality and is predicted to have poor chemical and quantitative quality in 2015.

3.3.3 The Staffordshire Trent Valley Mercia Mudstone East and Coal Measures water body has good chemical and quantitative quality and is predicted to remain at good chemical and quantitative quality in 2015.

3.3.4 Several superficial aquifers are located within the study area. These are: alluvium, river terrace deposits and glaciofluvial deposits, which are all designated as Secondary A aquifers.

3.3.5 There are two bedrock aquifers within the Whittington to Handsacre study area. The Sherwood Sandstone Group (containing the Kidderminster Formation and the Bromsgrove Sandstone Formation) is designated as a Principal aquifer and the Mercia Mudstone Group is designated as a Secondary B aquifer.

3.3.6 Strata not discussed in this section are considered to be unproductive by the Environment Agency.

3.3.7 The route crosses a groundwater catchment source protection zone (SPZ3) along the route from the border with the Drayton Bassett, Hints and Weeford area (CFA21) to Streethay. The study area encroaches on a groundwater source protection Zone 1 (SPZ1) and SPZ2 between Tewnals Lane and Hanch Farm to the south-east of Handsacre. An SPZ1 is present partially within the study area in the vicinity of Lichfield Trent Valley Station. It is surrounded by an SPZ2 (see Map WR-02-022).

3.3.8 There are five licensed groundwater abstractions within the study area, two of which are used for public water supply.

3.3.9 No unlicensed potable supplies have been identified within the study area.

3.3.10 Table 4 summarises licensed groundwater abstractions within the study area.

Table 4: Licensed groundwater abstractions

Licence identifier (map reference number ¹⁰ and Environment Agency reference)	Distance from route	Abstraction horizon	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Number of boreholes	Purpose
SPZ Groundwater Abstraction. Map WR-02-022 (G5). Located 925m south-west of Capper's Lane viaduct	740m west of the route	Bromsgrove Sandstone Formation	Information not provided	Information not provided	Information not provided	Public Water Supply
MD/028/0007/002 Map WR-02-022 (D3). Located 1.2km north of Trent and Mersey Canal East viaduct	1280m north-east of the route	Mercia Mudstone Group overlain by glaciofluvial deposits	98,618m ³	2,260m ³	1	Agriculture – General Farming and Domestic
03/28/07/0097 Seedy Mill – Borehole G (Water Treatment Works) Map WR-02-022 (D6). Located 800m south of Harvey's Rough flyover	650m south-west of the route	Mercia Mudstone Group overlain by glaciofluvial deposits	5,117,300m ³	19,190m ³	1	Industrial, Commercial And Public Services – Water Bottling
03/28/07/0097 Seedy Mill – Borehole H (Water Treatment Works) Map WR-02-022 (D6). Located 800m south of Harvey's Rough flyover	650m south-west of the route	Mercia Mudstone Group overlain by glaciofluvial deposits	5,117,300m ³	19,190m ³	1	Industrial, Commercial And Public Services – Water Bottling
SPZ Groundwater Abstraction. Map WR-02-022 (D6). Located 900m south of Harvey's Rough flyover	600m south-west of the route	Mercia Mudstone Group overlain by glaciofluvial deposits	Information not provided	Information not provided	Information not provided	Public Water Supply

3.3.11 Table 5 summarises groundwater discharge environmental permits within the study area.

¹⁰ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-022.

Appendix WR-002-022 | Baseline data

Table 5: Groundwater discharge environmental permits

Reference number and map reference ¹¹	Permit identifier	Distance from route	Discharge type	Receiving water body
3/28/22/0524/1, Whittington Heath Golf Club Map WR-02-022 (H5), 750m south-east of Darnford Lane overbridge	1243694	320m east of the route	Sewage effluent	Groundwater
3/28/22/2319/1, near Ellfield House Map WR-02-022 (H5), 140m south-east of Darnford Lane overbridge	1243954	120m east of the route	Sewage effluent	Groundwater
T/22/35662/T, Darnford Moors Golf Club Map WR-02-022 (G6), 940m west of Darnford Lane overbridge	19448935	900m west of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/22/0534/1, near Huddlesford House Map WR-02-022 (H4), 720m east of Capper's Lane viaduct	1243695	720m east of the route	Sewage effluent	Groundwater
3/28/22/2624, near Fulfen Farm Map WR-02-022 (G5), 750m west of Fulfen Farm viaduct	1243957	750m west of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/07/2685, Capper's Lane Map WR-02-022 (G5), 600m north-west of Capper's Lane viaduct	1244107	500m west of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
WQ/72/2279/1, Huddlesford Map WR-02-022 (G4), 570m east of Fulfen Wood viaduct	1243805	550m east of the route	Sewage effluent	Groundwater
WQ/72/2275, Streethay Map WR-02-022 (G5), 70m west of Streethay viaduct	1245877	70m west of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/22/1443/1, Streethay Map WR-02-022 (G4), 10m west of Streethay viaduct	1245770	10m west of the route	Sewage effluent	Groundwater
WQ/72/3217, East Hill Map WR-02-022 (F4), 1.2km north of Streethay viaduct	1245815	350m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
WQ/72/3218, East Hill Map WR-02-022 (F4), 1.2km north of Streethay viaduct	1245816	350m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway

¹¹ Map references taken from Volume 5:Map Book – Water resources, Map WR-02-022.

Reference number and map reference ¹¹	Permit identifier	Distance from route	Discharge type	Receiving water body
Wq/72/2575, near Fradley South Map WR-02-022 (F3), 1.4km north-east of Streethay viaduct	1245817	750m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/07/1799, near Fradley Junction Map WR-02-022 (E3), Fradley Wood	1245878	1000m north-east of Manchester spur	Sewage Discharge – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/07/1798, near Fradley Junction Map WR-02-022 (E3), Fradley Wood	1245880	1200m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/07/1797, near Fradley Junction Map WR-02-022 (E3), Fradley Wood	1245879	1100m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
3/28/16/1436/1, Tomhay Wood Map WR-02-022 (E5), 1km west of Trent and Mersey Canal West viaducts	1245813	600m south-west of the route	Sewage effluent	Groundwater
3/28/07/1669, west of Tomhay Wood Map WR-02-022 (E5), 1.7km west of Trent and Mersey Canal West viaducts	1245932	530m south of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway
T/05/36051/Sg, near Trent and Mersey Canal Map WR-02-022 (D5), 1.5km north-west of Trent and Mersey Canal West viaducts	27246147	800m north-east of the route	Sewage Discharges – Final/Treated Effluent – Not Water Company	Land/Soakaway

3.4 Groundwater/surface water interaction

3.4.1 Table 6 summarises springs, sinks and issues (locations where groundwater rises to the surface in a more diffuse way than at a spring) within the study area. Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the Proposed Scheme, or within the calculated zone of influence, and therefore potentially affected by the Proposed Scheme, have been included in the assessment.

Table 6 : Groundwater/surface water interaction

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Drain Map WR-02-022 (G5), located approximately 1.6km north-west of Whittington	Will be crossed by the route	Alluvium underlain by Bromsgrove Sandstone Formation	Not applicable	May receive baseflow from Secondary A and Principal aquifers

¹² Map references taken from Volume 5: Map Book – Water resources, Map WR-02-019 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Wyrley and Essington Canal (under restoration) Map WR-02-022 (G5), located approximately 1.6km north-west of Whittington	Will be crossed by the route	Also a water-dependent habitat. Refer to Table 7 for further information.		
Issues north of Fulfen Farm Map WR-02-022 (G5), located 620m north-west of Capper's Lane viaduct	450m west of the route	Bromsgrove Sandstone Formation	65mAOD	May receive water from Bromsgrove Sandstone
Pond in Fulfen Wood Map WR-02-022 (G5), located 1km north of Capper's viaduct	45m east of the route	Bromsgrove Sandstone Formation	68mAOD	May receive water from Bromsgrove Sandstone
Pond in Fulfen Wood Map WR-02-022 (G5), located 1.2km west of Streethay viaduct	135m east of the route	Bromsgrove Sandstone Formation	65mAOD	May receive water from Bromsgrove Sandstone
Tributary of Mare Brook Map WR-02-022 (G5), located 870m south of Capper's Lane viaduct	Will be crossed by the route	Bromsgrove Sandstone Formation	Not applicable	May receive water from Bromsgrove Sandstone
Pond at Hill Farm Map WR-02-022 (F4), located 440m south of Streethay viaduct	50m west of the route	Mercia Mudstone Group	76mAOD	Situated upon elevated topography, therefore unlikely to be groundwater dependent
Issues Map WR-02-022 (F5), located 620m north-west of Capper's Lane viaduct	1,200m west of the route	Bromsgrove Sandstone Formation	73mAOD	May receive water from Bromsgrove Sandstone
Pond Map WR-02-022 (F5), located 1.2km west of Streethay viaduct	1,100m west of the route	Bromsgrove Sandstone Formation	73mAOD	May receive water from Bromsgrove Sandstone
Tributary of Mare Brook Map WR-02-022 (G5), located 220m north of Capper's Lane viaduct	Will be crossed by the route	Bromsgrove Sandstone Formation	Not applicable	May receive baseflow from Principal Aquifer
Pond 190m north-west of "Rough Stockings" Map WR-02-022 (F4), located 700m north-west of Streethay viaduct	Will be crossed by the route	Mercia Mudstone Group	65mAOD	May receive water from Mercia Mudstone

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Two ponds 300m north-west of "Rough Stockings" Map WR-02-022 (F4), located 780m north-west of Streethay viaduct	70m west of the route	Mercia Mudstone Group	67mAOD	May receive water from Mercia Mudstone
Pond 250m south-west of East Hill (Business Park) Identifier 030-AA-186001 Map EC-04-063 (H5) and WR-02-022 (F4), located 940m north-west of Streethay viaduct	90m east of the route	Mercia Mudstone Group	65mAOD	Appears to be fed by drain therefore unlikely to be groundwater dependent
Minor tributary of River Trent Map WR-02-022 (F4), located 1km north-west of Streethay viaduct	Will be crossed by the route	Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary B aquifer
Minor tributary of River Trent Map WR-02-022 (F4), located 1.9km north-west of Streethay viaduct	Will be crossed by the route	Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary B aquifer
Issues 650m north-east of Curborough Farm Map WR-02-022 (F4), located 1km south-east of Trent and Mersey Canal East viaduct	270m west of the route	Mercia Mudstone Group	65mAOD	May receive water from Mercia Mudstone Group
Issues at Hunts Farm Map WR-02-022 (D6), located 1.5km south-west of Harvey's Rough flyover	1,200m west of the route	Mercia Mudstone Group	85mAOD	May receive water from Mercia Mudstone Group
Sinks at Hunts Farm Map WR-02-022 (D6), located 1.5km south-west of Harvey's Rough flyover	1,200m west of the route	Mercia Mudstone Group	85mAOD	Water most likely sinks into Mercia Mudstone Group
Issues 300m west of New Bridge Map WR-02-022 (E3), located 1.2km north-east of Trent and Mersey Canal East viaducts	1,000m north-east of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	65mAOD	May receive water from superficial Glaciofluvial Sheet Deposits

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Trent & Mersey Canal Map WR-02-022 (E4), will be crossed by Trent and Mersey Canal East viaduct	Will be crossed by the route	Also a water-dependent habitat. Refer to Table 7 for further information.		
Curborough Brook Map WR-02-022 (E4), will be crossed by Trent and Mersey Canal East viaduct	Will be crossed by the route	Also a water-dependent habitat. Refer to Table 7 for further information.		
Trent and Mersey Canal Map WR-02-022 (E4), will be crossed by Trent and Mersey Canal West viaduct	Will be crossed by the route	Also a water-dependent habitat. Refer to Table 7 for further information.		
Pond 100m west of Black Slough Wood Map WR-02-022 (D5), located 1.3km south-east of Harvey's Rough flyover	52m south-west of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	73mAOD	May receive water from Glaciofluvial Sheet Deposits
Drain Map WR-02-022 (E5), located 870m north-west of Trent and Mersey Canal East viaduct	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers
Issues at Rileyhill Farm Map WR-02-022 (D4), located 1.3km north-east of Harvey's Rough flyover	900m east of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	75mAOD	May receive water from Glaciofluvial Sheet Deposits
Two ponds 150m north of the junction between the A515 and Wood End Lane Map WR-02-022 (D5), located 765m south-east of Harvey's Rough flyover	90m south-west of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	80mAOD	May receive water from Glaciofluvial Sheet Deposits
Pond 260m east of Hanch Hall Farm Map WR-02-022 (D5), located 630m south-east of Harvey's Rough flyover	Will be crossed by connection with West Coast Main Line	Alluvium underlain by Mercia Mudstone Group	78mAOD	Appears to be a balancing pond for existing railway. Unlikely to be groundwater dependent.
Bourne-Bilson Brook Map WR-02-022 (D5), located 690m south-east of Harvey's Rough flyover	Will be crossed by the route	Alluvium and Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Pond within John's Gorse Map WR-02-022 (D5), located 570 north-west of Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	79mAOD	Possibly groundwater dependent. Pond outflow feeds into Bourne Brook, no inflow visible on available mapping.
Issues at Shaw Gap Map WR-02-022 (D4), located 1.5km north-east of Harvey's Rough flyover	1,900m east of the route	River Terrace Deposits underlain by Mercia Mudstone Group	65mAOD	May receive water from River Terrace Deposits Possibly an extended culvert
Two ponds 420m south-west of Kings Bromley Wharf Marina Map WR-02-022 (D5), located 530m south-east of Harvey's Rough flyover	200m north-east of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	79mAOD	May receive water from Glaciofluvial Sheet Deposits
Drain Map WR-02-022 (D5), will be crossed by Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers
Pond 220m north-west of Shaw House Map WR-02-022 (D5), located 80m east of Harvey's Rough flyover	60m north-east of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	78mAOD	May receive water from Glaciofluvial Sheet Deposits
Minor tributary of River Trent Map WR-02-022 (D6), located 210m west of Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers
Issues 350m west of Ashton Hayes Farm Map WR-02-022 (D6), located 460m north-west of Harvey's Rough flyover	370m west of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	77mAOD	May receive water from superficial Glaciofluvial Sheet Deposits
Minor tributary of River Trent Map WR-02-022 (D6), located 545m north-west of Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers
Minor tributary of River Trent Map WR-02-022 (D6), located 545m north-west of Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers

Location description and map reference ¹²	Distance from route	Formation	Elevation	Comments
Issues 300m north-west of Ashton Hayes Farm Map WR-02-022 (C6), located 1.2km south-east of Handsacre (centre)	25m west of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	75mAOD	May receive water from superficial Glaciofluvial Sheet Deposits
Issues at Brook Cottages Map WR-02-022 (C6), located 1km south of Handsacre (centre)	455m west of the route	Mercia Mudstone Group	80mAOD	May receive water from Mercia Mudstone
Minor tributary of River Trent Map WR-02-022 (C6), located 890m north-west of Harvey's Rough flyover	Will be crossed by the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	Not applicable	May receive baseflow from Secondary A and Secondary B aquifers
Spring at White Gables Map WR-02-022 (C6), located 880m north-west of Harvey's flyover	200m west of the route	Glaciofluvial Sheet Deposits underlain by Mercia Mudstone Group	75mAOD	May receive water from Glaciofluvial Sheet Deposits
Spring at Hood Lane Covert Map WR-02-022 (C6), located 1.5km north-west of Harvey's Rough flyover	1,400m west of the route	Mercia Mudstone Group	85mAOD	May receive water from Mercia Mudstone
Sinks at Brick Kiln Farm Map WR-02-022 (C6), located 650m south-west of Handsacre (centre)	1,000m north-west of the route	Mercia Mudstone Group	75mAOD	May sink into Mercia Mudstone Possibly an extended culvert
Issues 100m south of Old Road Farm Map WR-02-022 (C6), located 550m north-west of Handsacre (centre)	1,200m north-east of the route	Bromsgrove Sandstone Formation	70-75mAOD	May receive water from Bromsgrove Sandstone
Issues 200m west of Station Drive Handsacre Map WR-02-022 (C6), located 250m south-west of Handsacre (centre)	900m north-west of the route	Mercia Mudstone Group	80mAOD	May receive water from Mercia Mudstone Possibly an extended culvert

3.5 Water-dependent habitats

3.5.1 Table 7 summarises the potential water-dependent habitats within the study area. These have been identified from a review of OS mapping, aerial photography and from the following sources:

- information on designated and potential non-statutory Sites of Biological Importance (SBI) and Biodiversity Action Sites (BAS) from Staffordshire

Ecological Records;

- information on statutory designated sites from Natural England; and
- information from ecological surveys carried out in support of the Environmental Impact Assessment (EIA).

3.5.2 The table identifies where a water dependency may exist but the assessment of impact on water-dependent ecology receptors is found in Volume 2, CFA Report 22, Section 7.

Table 7: Description of water-dependent habitats

Location	Distance from the route	Designation	Comments
Whittington Heath Golf Club EC-01-061b, (B6), located 1.1km south-west of Whittington	Will be crossed by the route	SBI	Possibly dependent upon groundwater as situated upon permeable strata
Coventry Canal: Huddlesford to Whittington EC-01-062, (F3), stretch of canal between Huddlesford and Whittington	440m east of the route (at closest point)	SBI	Unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater
Wyrley and Essington Canal EC-01-062, (F5), stretch of canal between Darnform and Huddlesford	Will be crossed by the route	Identified by ecology as wet habitat of concern	Unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater
Huddlesford Strip EC-01-062, (E2), located along Park Lane, running eastwards from Huddlesford towards Burton Road, 530m east of Fulfen Wood viaduct	530m east of the route	BAS	Possibly dependent upon groundwater as situated upon permeable strata
Coventry Canal and associated habitats EC-01-062, (D5), stretch of canal between Whittington and Streethay	170m east of the route	Identified by ecology as wet habitat of concern	Unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater. Associated habitats most likely dependent upon water from the canal.
Undesignated woodland with drains and a pool EC-01-063, (H5), situated approximately 220m south-west of East Hill Business Park, Fradley	Will be crossed by the route	Identified by ecology as wet habitat of concern	Possibly dependent upon groundwater as situated upon permeable strata
Curborough House (south) Hedgerows EC-01-063, (G9), located 1.2km south of Trent and Mersey Canal East viaduct	760m west of the route	BAS	Unlikely to be groundwater dependent as the hedgerow is located on a road and there is no evidence that the receptor is wet
Curborough House Hedgerows EC-01-063, (E7), located 710m south-east of Trent and Mersey Canal East viaduct	250m west of the route	SBI	Unlikely to be groundwater dependent as the hedgerow is located on a road and there is no evidence that the receptor is wet

Location	Distance from the route	Designation	Comments
Big Lyntus EC-01-063, (D7), located 230m south of Trent and Mersey Canal East viaduct	215m west of the route	SBI, Ancient Woodland	Unlikely to be groundwater dependent as there is no evidence that the receptor is wet
Kings Bromley Wharf to Fradley Junction, Coventry Canal EC-01-063, (C5), located 80m south-east of Trent and Mersey Canal East viaduct	Will be crossed by the route	SBI	Unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater
Fradley Wood EC-01-063, (C4), located 200m east of Trent and Mersey Canal East viaduct	Adjacent to Manchester spur	BAS	Possibly dependent upon groundwater as situated upon permeable strata
Trent and Mersey Canal and associated habitat EC-01-063, (C7), will be crossed by Trent and Mersey Canal East viaduct	Will be crossed by the route	Identified by ecology as wet habitat of concern	Unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater
Curborough Hall Farm Hedgerows EC-01-063, (D10), located 600m south-west of Trent and Mersey Canal West viaduct	620m south-east of the route	BAS	Unlikely to be groundwater dependent as the hedgerow is located on a road and there is no evidence that the receptor is wet
Pool Wood and Fradley Reservoir EC-01-063, (A3), located at Fradley Junction 710m north-east of Trent and Mersey Canal East viaduct	370m east of the route (from Manchester Spur)	SBI	Possibly dependent upon groundwater as situated upon permeable strata. Citation suggests that the receptor is wet as there is a swamp at the western edge of the reservoir.
Wood End Lock (near) EC-01-063, (C7), located on the outer bend of the Trent and Mersey Canal close to Wood End Farm, 110m south-west of Trent and Mersey Canal East viaduct	145m south-west of the route	SBI	Possibly dependent upon groundwater as situated upon permeable strata
Curborough Brook and associated habitat Map: EC-01-063, (B7), located on the inner bend of the Trent and Mersey Canal, approximately 1.9km south-east of Rileyhill	Will be crossed by the route	Identified by ecology as wet habitat of concern	Possibly dependent upon groundwater as situated upon permeable strata
Ravenshaw Wood, Black Slough and Slash Map: EC-01-064, (G6), located 220m north-west of Trent and Mersey Canal West viaduct	Will be crossed by the route	SBI, Ancient Woodland	Possibly dependent upon groundwater as situated upon permeable strata

Location	Distance from the route	Designation	Comments
Tomhay Wood Map: EC-01-064, (G9), located 1.1km west of Trent and Mersey Canal West viaduct	450m south of the route	SBI, Ancient Woodland	Possibly dependent upon groundwater as situated upon permeable strata
Vicar's Coppice Map: EC-01-064, (E8), located 65m west of A515 Lichfield Road underbridge	50m south of the route	BAS, Ancient Woodland	Possibly dependent upon groundwater as situated upon permeable strata
The Roundabout Map: EC-01-064, (E10), located 745m south-west of A515 Lichfield Road underbridge	770m south of main line 330m south of connection with West Coast Main Line	BAS	Possibly dependent upon groundwater as situated upon permeable strata and flat topography with ponds present
John's Gorse, Hanch Wood Map: EC-01-064, (D7), located 240m north-west of A515 Lichfield Road underbridge	Will be crossed by the route	SBI, Ancient Woodland	Possibly dependent upon groundwater as identified as wet woodland in the ecological citation and is situated upon permeable strata
Unnamed ancient woodland south west of Hanchwood House Map: EC-01-064, (C8), located 495m north-west of A515 Lichfield Road underbridge	Will be crossed by the route	Ancient Woodland	Unlikely to be groundwater dependent as there is no evidence that the site is wet and there are no groundwater features such as springs in the vicinity
Riley Hill Map: EC-01-064, (D2), located 1.2km north-east of A515 Lichfield Road underbridge	400m south-west of Manchester Spur	Retained BAS	Possibly dependent upon groundwater as situated upon permeable strata and damp ground is suggested in the citation
Tuppenhurst Lane (west of) Map: EC-01-065, (G5), located 565m north-west of Harvey's Rough flyover	10m north-east of the route	SBI	Possibly dependent upon groundwater – described as "A wet area with marshy grassland, swamp". Headwater stream source from west of route.

4 Site-specific assessments

4.1 Surface water

4.1.1 The following table summarises the potential impacts and effects to surface water.

Table 8: Summary of potential impacts to surface water

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain feeder to Fisherwick Brook at Mill Farm (SWC-CFA22-001) Map WR-01-037 (E5)	Moderate	Realignment of Darnford Lane (assume local drainage connects)	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids;	Adoption of Environment Agency Pollution Prevention Guidelines (PPG) – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
		Earthworks Drainage outfall Balancing pond Capper's Lane viaduct		The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.				
		Realignment of Darnford Lane (assume local drainage outfall connects)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from routine discharges or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

¹³ Map references taken from Volume 5: Map Book – water resources, Maps WR-01-037 and WR-01-038.¹⁴ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Wyrley and Essington Canal (under restoration) at Canal Cottage Cappers Lane (SWC-CFA22-002) Map WR-01-037 (E5)	Moderate	Drainage outfall Balancing pond Earthworks Capper's Lane viaduct Capper's Lane auto-transformer station	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of Mare Brook at Birch Wood – Streethay (SWC-CFA22-003) Map WR-01-037 (E5)	Moderate	Fulfen Wood culvert Watercourse realignment Drainage outfall Balancing pond Earthworks and drainage	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral (not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral (not significant)</p>	Construction (Permanent)
		Fulfen Wood culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial (not significant)</p>	<p>None required</p>	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial (not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Watercourse realignment	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Mare Brook at Rough Stockings – Streethay (SWC-CFA22-004) Map WR-01-037 (C6)	Moderate	Mare Brook south culvert	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
		Mare Brook south culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Watercourse realignment	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
Pond north of Rough Stockings (SWC-CFA22-005)	Refer to Ecology Volume 2, CFA Report 22, Section 7, for impacts assessment.								
Map WR-01-037 (C6)									

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of Mare Brook at East Hill – Hilliards Cross (SWC-CFA22-006) Map WR-01-037 (B6)	Moderate	Mare Brook north culvert Watercourse realignment Drainage outfall Balancing pond	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral (not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral (not significant)</p>	Construction (Permanent)
		Mare Brook north culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial (not significant)</p>	<p>None required</p>	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial (not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Watercourse realignment	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of Mare Brook at Wood End Lane – Hilliards Cross (SWC-CFA22-007) Map WR-01-037 (B6)	Moderate	Drainage outfall Balancing pond Diverted Wood End Lane Watercourse realignment Culvert	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		Drainage outfall from road (assumed drainage from Wood Lane End)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Watercourse realignment	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		Culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Pond at Wood End Lock (SWC-CFA22-008) Map WR-01-038 (G5)	Refer to Ecology Volume 2, CFA Report 22, Section 7, for impacts assessment.								

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Trent and Mersey Canal at Fradley Wood (SWC-CFA22-009) Map WR-01-038 (G5)	Moderate	Drainage outfall Balancing pond Trent and Mersey Canal East viaduct Curborough embankment Curborough retaining structure no. 2 Curborough retaining structure no. 3 Lyntus auto-transformer station.	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Curborough Brook crossing at Wood End Lock (SWC-CFA22-010) Map WR-01-038 (G5)	High	Pyford Brook viaducts Pyford Brook retaining structure Pyford Brook east embankment Earthworks Drainage outfalls Balancing ponds	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation
Licensed surface water abstraction from Pyford Brook catchment Map WR-01-038 (G5)	High	Abstraction point assumed to be within proposed works footprint	Major adverse	Loss of abstraction point	Relocation of abstraction point.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Trent and Mersey Canal at Wood End Lock (SWC-CFA22-011) Map WR-01-038 (F5)	Moderate	Trent and Mersey Canal west viaducts Drainage outfall Balancing pond Earthworks	Moderate adverse	Deterioration of water quality due to: Deposition or spillage of soils, sediment, fuels or other construction materials; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain at Black Slough (watercourse does not intersect route) Map WR-01-038 (E7)	Low	Drainage outfall Balancing pond	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Bourne Brook at John's Gorse (SWC-CFA22-012) Map WR-01-038 (E7)	High	Bourne Brook viaduct Balancing pond Drainage outfall A515 Lichfield Road underbridge Watercourse enhancements	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation
Pond at John's Gorse (SWC-CFA22-013) Map WR-01-038 (E8)	Refer to Ecology Volume 2, CFA Report 22, Section 7, for impacts assessment.								

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain at Harvey's Rough / Shaw Lane Farm (SWC-CFA22-014)	Moderate	Harveys Rough flyover Harveys Rough retaining structure no. 1 Harveys Rough retaining structure no. 4	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Trent at Harvey's Rough (SWC-CFA22-015) Map WR-01-038 (D8)	Moderate	Culvert Harvey's Rough retaining structure no. 2 Harvey's Rough retaining structure no. 3	Moderate adverse	Deterioration of water quality due to: Deposition or spillage of soils, sediment, fuels or other construction materials; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Trent at Ashton Hays (SWC-CFA22-016) Map WR-01-038 (C8)	Moderate	Culvert	Moderate adverse	<p>Deterioration of water quality due to:</p> <p>Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids;</p> <p>The mobilisation of contaminants following disturbance of contaminated ground or groundwater;</p> <p>Uncontrolled site run-off.</p> <p>In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.</p>	<p>Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.</p> <p>Mitigation measures outlined in draft CoCP.</p> <p>Water management implemented during earthworks operation.</p> <p>Temporary site drainage designed to retain surface run-off within site boundary.</p> <p>Grey water systems used at main and satellite construction compounds.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Temporary)
		Culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	<p>None required</p>	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Trent at Lichfield Road (B5014) (SWC-CFA22-017) Map WR-01-038 (C8)	Moderate	Handsacre East culvert	Moderate adverse	<p>Deterioration of water quality due to:</p> <p>Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids;</p> <p>The mobilisation of contaminants following disturbance of contaminated ground or groundwater;</p> <p>Uncontrolled site run-off.</p> <p>In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.</p>	<p>Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.</p> <p>Mitigation measures outlined in draft CoCP.</p> <p>Water management implemented during earthworks operation.</p> <p>Temporary site drainage designed to retain surface run-off within site boundary.</p> <p>Grey water systems used at main and satellite construction compounds.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Temporary)
Tributary of River Trent at Lichfield Road (B5014) (CFA22-SW-077)	Moderate	Handsacre East culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	<p>None required</p>	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Trent at White Gables (SWC-CFA22-018) Map WR-01-038 (C8)	Moderate	Handsacre West culvert extension Balancing pond Drainage outfall	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹³	Value of surface water feature ¹⁴	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall from railway	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		Handsacre West culvert extension	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	<p>None required</p>	<p>Minor to Minor Beneficial</p> <p>Slight to Slight Beneficial</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

4.2 Groundwater

4.2.1 Following the methodology outlined in the SMR addendum (see Volume 5: Appendix CT-001-000/2), the hydraulic conductivity values; obtained from available literature values, were used in conjunction with professional judgment to estimate the maximum extent of the zone of influence that is likely to be produced when dewatering of a cutting occurs. The hydraulic conductivity values used are generally in the high range of literature values to provide a realistic factor of safety to the estimated zone of influence. Based on this worst case assumption, the zone of influence is likely to be overestimated, however for the purpose of this preliminary assessment, this approach is considered to be acceptable.

4.2.2 Aquifer properties used for estimating the zone of influence can be found in Table 9.

Table 9: Aquifer properties

Lithology	Maximum hydraulic conductivity value used in calculations	References
Bromsgrove Sandstone Formation	2.71m/d	BGS Aquifers Properties Manual ¹⁵
Kidderminster Sandstone Formation	33.3m/d	BGS Aquifers Properties Manual
Mercia Mudstone Group-Mudstone and Dolomitic siltstone	0.1m/d	Tellam and Lloyd ¹⁶
Alluvium	864m/d	Hiscock 2005 ¹⁷
River Terrace Deposits	51.8m/d	An average of sand values from Domenico and Schwartz 1990 ¹⁸
Glaciofluvial Deposits Sand and Gravel	86.4m/d	Hiscock 2005
Glaciolacustrine Deposits – clay and silt	0.0000864m/d	Hiscock 2005
Head Deposits	0.173m/d	Domenico, PA and FW Schwartz, 1990

4.2.3 The zone of influence for the dewatering of the cuttings along the route was calculated at frequent intervals as topography, geology and track level changed, using the methodology outlined in the SMR addendum (see Volume 5: Appendix CT-001-000/2) and the properties in Table 9. Table 10 summarises the estimated zone of influence within the study area for each of the cuttings. In each case, the maximum zone of influence value reported has not been applied to the whole extent of the cutting; it is purely illustrative of the worst-case conditions at its deepest section.

¹⁵ British Geological Survey (1997). *The Physical Properties of Major Aquifers in England and Wales*. P199.

¹⁶ Tellam J.H. and Lloyd J.W. (1981). *A review of the hydrogeology of British onshore non-carbonate mudrocks*. Quarterly Journal of Engineering Geology and Hydrogeology 1981, v.14; p347-355.

¹⁷ Hiscock, K.M. (2005), *Hydrogeology: Principles and Practice*, Blackwell Science Ltd, Oxford.

¹⁸ Domenico, P.A. and F.W. Schwartz, 1990. *Physical and Chemical Hydrogeology*, John Wiley & Sons, New York.

Table 10: Maximum extent of zone of influence in the Whittington to Handsacre study area

Cutting	Geology	Maximum drawdown within cutting	Maximum zone of influence estimated from maximum drawdown	Comments
Swinfen cutting	Kidderminster Formation and Bromsgrove Sandstone Formation	8m	340m	Bulk hydraulic conductivity used
Whittington Common cutting	Bromsgrove Sandstone Formation	2m	34m	-

4.2.4 Table 11 summarises the potential impacts to groundwater, abstractions, water-dependent habitats and groundwater/ surface water interactions.

Appendix WR-002-022 | Site-specific assessments

Table 11: Summary of potential impacts to groundwater, abstractions, water-dependent habitats and groundwater/surface water interactions

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Aquifers								
Sherwood Sandstone Group – Bromsgrove Sandstone Formation Principal aquifer (high).	Various including: Streethay sidings; Whittington Heath embankment; Swinfen cutting; Whittington Common cutting; Capper's Lane viaduct; Fulfen Wood viaduct; Worsites; Construction traffic route.	Major adverse	<p>Streethay sidings – proposed location of the materials transfer stockpile is partially located upon the Bromsgrove Sandstone Formation.</p> <p>The large area of the stockpile could prevent infiltration into groundwater, resulting in reduced groundwater levels in the vicinity of the stockpile.</p> <p>Potential contamination associated with the use of diesel trains for transporting material to and from the stockpiles could occur.</p>	<p>Contamination control measures as required by the draft CoCP Section 16.</p> <p>Sustainable drainage systems (SuDS) such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	<p>Construction (Permanent)</p>

¹⁹ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-022 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

²⁰ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Mercia Mudstone Group – Secondary B aquifer (moderate).	Various including: Viaducts; Embankments; Worsites; Construction traffic route.	Major adverse	<p>Streethay sidings – proposed location of the materials transfer stockpile is partially located upon the Mercia Mudstone Group.</p> <p>The large area of the stockpile could prevent infiltration into groundwater, resulting in reduced groundwater levels in the vicinity of the stockpile.</p> <p>Potential contamination associated with the use of diesel trains for transporting material to and from the stockpiles could occur.</p>	<p>Contamination control measures as required by the draft CoCP Section 16.</p> <p>Sustainable drainage systems such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)
Alluvium Secondary A aquifer (moderate).	Embankments; Viaducts.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	None
River Terrace Deposits Secondary A aquifer (moderate).	Streethay embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Glaciofluvial Sheet Deposits Secondary A aquifer (moderate).	Embankments; Viaducts.	Major adverse	<p>Streethay sidings – proposed location of the materials transfer stockpile is partially located upon the Secondary A aquifer.</p> <p>The large area of the stockpile could prevent infiltration into groundwater, resulting in reduced groundwater levels in the vicinity of the stockpile.</p> <p>Potential contamination associated with the use of diesel trains for transporting material to and from the stockpiles could occur.</p>	<p>Contamination control measures as required by the draft CoCP Section 16.</p> <p>SuDS such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)
Abstractions								
SPZ Groundwater Abstraction (assumed) at Streethay Lodge (high). Map WR-02-022 (G5) located 925m south-west of Capper's Lane viaduct.	<p>Streethay viaduct</p> <p>Fulfen Wood North embankment</p>	Minor adverse	<p>SPZ2 is 280m and SPZ1 is 500m from material transfer stockpile at Capper's Lane (part of Streethay Sidings). Sidings present a possible source of contamination due to the use of diesel trains and plant equipment. It is assumed that materials classified as contaminated would not be brought to the stockpile site.</p>	<p>SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.</p> <p>Contamination control measures as required by the draft CoCP Section 16.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Temporary)

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Groundwater Abstraction: MD/028/0007/002 (moderate) Map WR-03-022, D3. Located 1.2km north of Trent and Mersey Canal East viaduct.	Ravenshaw Wood embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/07/0097 Seedy Mill – Borehole G (Water Treatment Works) (moderate) Map WR-03-022, D6 Located 800m south of Harvey's Rough flyover	Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/07/0097 Seedy Mill – Borehole H (Water Treatment Works) (moderate) Map WR-03-22, D6 located 800m south of Harvey's Rough flyover.	Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
SPZ Groundwater Abstraction (assumed) Seedy Mill (high) Map WR-02-22, D6 located 900m south of Harvey's Rough flyover.	Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater..	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Water Dependent Habitats								
Whittington Heath Golf Club (moderate) Map EC-01-061b, (B6), located 1.1km south-west of Whittington.	Whittington Heath embankment	Minor adverse	Receptor is crossed by the route. Piling activities, reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site. Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)
Coventry Canal: Huddlesford to Whittington (moderate) Map EC-01-062, (F3), stretch of canal between Huddlesford and Whittington.	Whittington Common cutting Huddlesford embankment	Negligible	Receptor assessed as unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Wyrley and Essington Canal (high) Map EC-01-062, (F5), stretch of canal between Darnform and Huddlesford.	Huddlesford embankment Capper's Lane viaduct	Negligible	Receptor assessed as unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Huddlesford Strip (moderate) Map EC-01-062, (E2), located along Park Lane, running eastwards from Huddlesford towards Burton Road, 530m east of Fulfen Wood viaduct.	Fulfen Wood South embankment Fulfen Wood viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Coventry Canal and associated habitats (high) Map EC-01-062, (D5), stretch of canal between Whittington and Streethay.	Fulfen Wood North embankment Streethay viaduct Streethay sidings.	Negligible	Receptor assessed as unlikely to be groundwater dependent as this is an artificial watercourse and is therefore isolated from groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Undesignated woodland with drains and a pool (moderate) Map EC-01-063, (H5), situated approximately 220m south-west of East Hill Business Park, Fradley.	Streethay embankment.	Minor adverse	Crossed by the route. Parts of the receptor and the pool are likely to be lost to the scheme and, therefore, have not been assessed. Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Piling activities, reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Curborough House (south) hedgerows (moderate) Map EC-01-063, (G9), located 1.2km south of Trent and Mersey Canal East viaduct.	Streethay embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Curborough House Hedgerows (moderate) Map EC-01-063, (E7), located 710m south-east of Trent and Mersey Canal East viaduct.	Streethay embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Big Lyntus (high) Map EC-01-063, (D7), located 230m south of Trent and Mersey Canal East viaduct.	Curborough embankment. Curborough flyover Pyford Brook East embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Kings Bromley Wharf to Fradley Jn, Coventry Canal (moderate) Map EC-01-063, (C5), located 80m south-east of Trent and Mersey Canal East viaduct.	Curborough embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Fradley Wood (moderate) Map EC-01-063, (C4), located 200m east of Trent and Mersey Canal East viaduct.	Pyford Brook East embankment Pyford Brook viaducts Pyford Brook West embankment Manchester spur.	Minor adverse	Crossed by the route. Parts of the receptor are likely to be removed during construction of the Proposed Scheme Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Piling activities, reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)
Trent and Mersey Canal and associated habitat (high) Map EC-01-063, (C7), will be crossed by Trent and Mersey Canal East viaduct.	Trent and Mersey Canal North viaduct Curborough embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Curborough Hall Farm Hedgerows (moderate) Map EC-01-063, (D10), located 600m south-west of Trent and Mersey Canal West viaduct.	Trent and Mersey Canal North viaduct Curborough embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pool Wood and Fradley Reservoir (moderate) Map EC-01-063, (A3), situated at Fradley Junction 710m north-east of Trent and Mersey Canal East viaduct.	Trent and Mersey Canal North viaduct Curborough Embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Wood End Lock (near) (moderate) Map EC-01-063, (C7), situated on the outer bend of the Trent and Mersey Canal close to Wood End Farm 110m south-west of Trent and Mersey Canal East viaduct.	Trent and Mersey Canal North viaduct Curborough embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Curborough Brook and associated habitat (moderate) Map EC-01-063, (B7), located on the inner bend of the Trent and Mersey Canal, approximately 1.9km south-east of Rileyhill.	Pyford Brook West embankment. Pyford Brook viaduct Pyford Brook East embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Ravenshaw Wood, Black Slough and Slash (high) Map EC-01-064, (G6), located 220m north-west of Trent and Mersey Canal West viaduct.	Ravenshaw Wood embankment Trent and Mersey Canal West viaducts.	Minor adverse	Will be crossed by the route. Parts of the receptor are likely to be removed during construction of the Proposed Scheme. Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
Tomhay Wood (high) Map EC-01-064, (G9), located 1.1km west of Trent and Mersey Canal West viaduct.	Ravenshaw Wood embankment.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Vicar's Coppice (high) Map EC-01-064, (E8), located 65m west of A515 Lichfield Road underbridge.	Ravenshaw Wood embankment.	Minor adverse	Will be crossed by the route. Parts of the receptor are likely to be removed during construction of the Proposed Scheme Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
The Roundabout (moderate) Map EC-01-064, (E10), located 745m south-west of A515 Lichfield Road underbridge.	Ravenshaw Wood embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
John's Gorse, Hanch Wood (high) Map EC-01-064, (D7), located 240m north-west of A515 Lichfield Road underbridge.	Shaw Lane embankment	Minor adverse	Crossed by the route. Parts of the receptor are likely to be removed during construction of the Proposed Scheme. Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Piling activities, reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
Unnamed ancient woodland south west of Hanchwood House (moderate) Map EC-01-064, (C8), 495m north-west of A515 Lichfield Road underbridge	Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Riley Hill (moderate) Map EC-01-064, (D2). Located 1.2km north-east of A515 Lichfield Road underbridge.	Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tuppenhurst Lane (west of) (moderate) Map EC-01-065, (G5). Located 565m north-west of Harvey's Rough flyover.	Lilac embankment. Handsacre retained wall Handsacre East culvert.	Minor adverse	Will be crossed by the route. Parts of the receptor are likely to be removed during construction of the Proposed Scheme Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater. Piling activities, reduced infiltration and minor excavations in vicinity could have a minor impact on the water balance of the site.	None required	Minor Slight (not significant)		Minor Slight (not significant)	Construction (Temporary)
Groundwater/ Surface Water Interactions								
Drain will be crossed by the route. (moderate) Map WR-02-022 (G5). Located approximately 1.6km north-west of Whittington	Huddlesford Embankment Capper's Lane viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues north of Fulfen Farm, 450m west of the route. (moderate) Map WR-02-022 (G5) located 620m north-west of Capper's Lane viaduct.	Fulfen Wood viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond in Fulfen Wood, 45m east of the route. (low) Map WR-02-022 (G5) located 1km north of Capper's viaduct	Streethay sidings area	Major adverse	Within the footprint of the Streethay sidings area and therefore pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Pond in Fulfen Wood, 135m east of the route. (low) Map WR-02-022 (G5) located 1.2km west of Streethay viaduct.	Streethay sidings area	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Tributary of Mare Brook, will be crossed by the route. (moderate) Map WR-02-022 (G5). Located 870m south of Capper's Lane viaduct.	Streethay embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond at Hill Farm, 50m west of the route. (low) Map WR-02-022 (F4) located 440m south of Streethay viaduct.	Fulfen Wood north embankment Streethay sidings area	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Issues, 1,200m west of the route. (moderate) Map WR-02-022 (F5) located 620m north-west of Capper's Lane viaduct	Streethay sidings area	Minor adverse	Possible impact to issues which arise at the edge of a stockpile area. Possible impediment of groundwater flow in the vicinity of the issues. Potential contamination could occur to groundwater and hence impact the issues and surface watercourse.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond, 1,100m west of the route. (low) Map WR-02-022 (F5) located 1.2km west of Streethay viaduct.	Streethay sidings area	Major adverse	Within the footprint of the Streethay sidings area and therefore pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Tributary of Mare Brook, will be crossed by the route. (moderate) Map WR-02-022 (G5) located 220m north of Capper's Lane viaduct.	Fulfen Wood North embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond 190m north-west of "Rough Stockings", will be crossed by the route. (low) Map WR-02-022 (F4) located 700m north-west of Streethay viaduct.	Streethay embankment	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Two ponds 300m north-west of "Rough Stockings", 70m west of the route. (low) Map WR-02-022 (F4) located 780m north-west of Streethay viaduct.	Streethay embankment	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond 250m south-west of East Hill (Business Park), 90m east of the route. (low) Identifier 030AA-186001 Map WR-02-022 (F4) located 940m north-west of Streethay viaduct.	Streethay embankment	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (F4) located 1km north-west of Streethay viaduct.	Streethay embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (F4). Located 1.9km north-west of Streethay viaduct.	Streethay embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 650m north-east of Curborough Farm, 270m west of the route. (moderate) Map WR-02-022 (F4) located 1km south-east of Trent and Mersey Canal East viaduct.	Fulfen Wood North embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues Hunts Farm, 1,200m west of the route. (moderate) Map: WR-02-022 (D6) located 1.5km south-west of Harvey's Rough flyover.	Curborough Flyover	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks at Hunts Farm 1,200m west of the route. (moderate) Map WR-02-022 (D6) located 1.5km south-west of Harvey's Rough flyover.	Curborough Flyover	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 300m west of New Bridge, 1,000m north-east of the route. (moderate) Map WR-02-022 (E3) located 1.2km north-east of Trent and Mersey Canal East viaducts.	Curborough Flyover	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond 100m west of Black Slough Wood, 52m south-west of the route. (low) Map WR-02-022 (D5) located 1.3km south-east of Harvey's Rough flyover.	Ravenshaw Wood embankment	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme..	Refer to Ecology Volume 2, CFA Report 22, Section 7.				

Appendix WR-002-022 | Site-specific assessments

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain will be crossed by the route. (moderate) Map WR-02-022 (E5) Located 870m north-west of Trent and Mersey Canal East viaduct.	Ravenshaw Wood embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues at Rileyhill Farm 900m east of the route. (moderate) Map WR-02-022 (D4) located 1.3km north-east of Harvey's Rough flyover	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Two ponds 150m north of junction of A515 with Wood End Lane, 90m south-west of the route. (low) Map WR-02-022 (D5) located 765m south-east of Harvey's Rough flyover.	Ravenshaw Wood embankment	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Pond 260m east of Hanch Hall Farm, will be crossed by connection with West Coast Main Line. (low) Map WR-02-022 (D5) located 630m south-east of Harvey's Rough flyover.	Bourne Brook viaduct	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Bourne-Bilson Brook, will be crossed by the route. (high/ very high) Map WR-02-022 (D5). Located 690m south-east of Harvey's Rough flyover.	Bourne Brook viaduct Shaw Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond within John's Gorse, will be crossed by the route. (low) Map WR-02-022 (D5) located 570 north-west of Harvey's Rough flyover.	Bourne Brook viaduct	Major adverse	Within the land required for the Proposed Scheme and, therefore, pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Issues at Shaw Gap, 1,900m east of the route. (moderate) Map WR-02-022 (D4) located 1.5km north-east of Harvey's Rough flyover.	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Two ponds 420m SW of Kings Bromley Wharf Marina, 200m north-east of the route. (low) Map WR-02-022 (D5) located 530m south-east of Harvey's Rough flyover.	Shaw Lane Embankment; Bourne Brook viaduct	Major adverse	Within the land required for the Proposed Scheme and therefore pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain, will be crossed by the route. (moderate) Map WR-02-022 (D5). Will be crossed by Harvey's Rough flyover.	Shaw Lane embankment Harvey's Rough flyover	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond 220m north-west of Shaw House, 60m north-east of the route. (low) Map WR-02-22 (D5) located 80m east of Harvey's Rough flyover.	Harvey's Rough flyover	Major adverse	Within the land required for the Proposed Scheme and therefore pond assumed to be removed during construction of the Proposed Scheme.	Refer to Ecology Volume 2, CFA Report 22, Section 7.				
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (D6). Located 210m west of Harvey's Rough flyover.	Lilac embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 350m west of Ashton Hayes Farm, 370m west of the route. (moderate) Map WR-02-022 (D6) located 460m north-west of Harvey's Rough flyover	Lilac embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (D6). Located 545m north-west of Harvey's Rough flyover.	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (D6). Located 545m north-west of Harvey's Rough flyover.	Lilac embankment. Handsacre retaining wall Handsacre East culvert	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater..	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 300m north-west of Ashton Hayes Farm, 25m west of the route. (moderate) Map WR-02-022 (C6) located 1.2km south east of Handsacre (centre)	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues at Brook Cottages, 455m west of the route. (moderate) Map WR-02-022 (C6) located 1km south of Handsacre (centre).	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Appendix WR-002-022 | Site-specific assessments

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Minor tributary of River Trent, will be crossed by the route. (moderate) Map WR-02-022 (C6). Located 890m north-west of Harvey's Rough flyover	Lilac embankment. Handsacre retaining wall Handsacre West culvert extension.	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Spring at White Gables, 200m west of the route. (moderate) Map WR-02-022 (C6) located 880m north-west of Harvey's flyover.	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Spring at Hood Lane Covert, 1,400m west of the route. (moderate) Map WR-02-022 (C6) located 1.5km north-west of Harvey's Rough flyover.	Lilac embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks at Brick Kiln Farm, 1,000m north-west of the route. (moderate) Map WR-02-022 (C6) located 650m south west of Handsacre (centre).	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ¹⁹ (and value) ²⁰	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues 100m south of Old Road Farm, 1,200m north-east of the route. (moderate) Map WR-02-022 (C6). located 550m north west of Handsacre (centre).	Lilac embankment. Handsacre retaining wall	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 200m west of Station Drive Handsacre, 900m north-west of the route. (moderate) Map WR-02-022 (C6) located 250m south west of Handsacre (centre)	West Coast Main Line embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

5 References

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